VENETIAN BLIND HAVING DUAL-DRIVE MECHANISM.

By

Ming Nien, Song-He Lui, and Yu-Che Wen

CROSS REFERENCE TO RELATED APPLICATIONS

This application claims the benefit of Taiwan applications Ser. Nos. 91123868 and 911202679, both filed October 11, 2002, and is a Continuation-in-Part of U.S. Application Serial Nos. 10/143,300 and 10/065,936, filed on May 14 and December 2, 2002, respectively, these U.S. applications being incorporated herein by this reference.

BACKGROUND

The present invention relates to Venetian blinds and, more specifically, transmission mechanisms and controls for manual and motor-driven blinds.

A variety of blinds including Venetian blinds, roller blinds, pleated blinds, honeycomb shades, accordion-like shades, Roman blinds, vertical blinds, curtains, and etc. are commercially available for use with a window to regulate the light, air, etc. A regular Venetian blind comprises headrail, a bottom rail, a plurality of slats arranged in parallel between the headrail and the bottom rail, a spacing adjustment or height control mechanism for controlling lifting and positioning of the bottom rail to change the

extending area of the blind, a frequency modulation or phase control mechanism for controlling the tilting angle of the slats to regulate the light. The height control mechanism typically includes an endless lift cord suspended from the headrail at one lateral side for pulling by hand to lift/lower the bottom rail. The phase control mechanism comprises a phase member disposed at one lateral side of the blind for permitting rotation by the user to regulate the tilting angle of the slats. When adjusting the elevation of the bottom rail, the user must approach the blind and pull the lift cord by hand with much effort. Further, because the lift cord is not kept out of reach of children, children may pull the lift cord for fun. In case the lift cord is hung on a child's head, a fatal accident may occur. In order to eliminate this problem, blinds without exposed lift cords are disclosed. These blinds commonly use spring means and the gravity weight of the blind body to keep the blind body at the adjusted elevational position. However these blinds are not durable in use because the provided spring means wears quickly with use. U.S. Patent No. 6,044,889 to Liu teaches the use of the tension of two cord members to hold the bottom rail of a Venetian blind at the adjusted elevation. However, the cord members are likely to become loosened after a long use. Further, the presence of the cord members destroys the sense of beauty of the blind.

US Patent No. 5,103,888 to Nakamura discloses a blind slats lifting

device that includes a pair of lifting cords that are wound onto respective winding drums that are driven by means of a loop of operation cord. Motor-driven blinds, which keep lift cords from sight are also known. According to one design, a motor is mounted in the headrail or bottom rail, and controlled by a remote controller to roll up or let off the lift cord. The motor is used to control lifting of the lift cord only. When adjusting the tilting angle of the slats, the user must approach the blind and touch-control a tilting control unit. This operation manner is still not convenient.

Electrically controlled blinds can be made easy to operate, and they can have improved appearance in that they do not require exposed lift cords or tilt rods, and the absence of an exposed lift cord is a safety feature. However, electrically controlled blinds are typically expensive to provide, each unit having at least one motor, a power supply device, and a control circuit. Also, the power supply device requires a battery or an external source of power, which in turn normally requires a power cord and a suitable power socket. Because of the problems associated with providing external power, typical devices of the prior art use battery power. However, because the battery of the power supply device of an electrically controlled blind is normally installed in the headrail, it is inconvenient to replace the battery when battery power low.

Thus there is a need for a blind control system and method

that has no cord member exposed to the outside of the blind body, that does not require any exposed lift cord or tilt rod means, that enables the user to conveniently regulate the blind either manually or electrically, that is inexpensive to provide, and that otherwise avoids the disadvantages of the prior art.

SUMMARY

The present invention meets this need by providing a Venetian blind having a single driver for adjusting both the position and orientation of blinds. In one aspect of the invention, the blind includes a headrail, a bottom rail, a set of slats supported between the headrail and the bottom rail, and a blind control system that includes a spacing adjustment set having a support, a spacing cord connected to at least one of the slats and adapted to decrease or increase a spacing between pairs of the slats, and a spacing adjustment wheel rotatably engaged to the support to roll up or let off the spacing cord; an angle adjustment set having an angle cord adapted to tilt the slats, an angle adjustment member rotatably supported relative to the support and adapted to roll up or let off the angle cord; and a drive mechanism for selectively driving the spacing adjustment wheel and the angle adjustment member to adjust both the spacing and tilt of the slats. In one preferred configuration, the drive mechanism includes an operating device coupled to the spacing adjustment wheel; a friction coupling

between the spacing adjustment wheel and the angle adjustment member; and a stop device coupled between the angle adjustment member and the support to limit rotation of the angle adjustment member to a predetermined angle. In this configuration, the angle adjustment member is rotated by the spacing adjustment wheel as limited by the stop device upon rotary motion of the spacing adjustment wheel, thereby permitting adjustment of both the height and tilt of the blinds by driving the spacing adjustment wheel directly and the angle adjustment member indirectly.

The stop device can include a shoulder projecting at one side of the support, and a protruding block projecting from the angle adjustment member and adapted to act against the shoulder of the support. The friction coupling can include a biasing device which can be a coiled spring mounted between the support and the angle adjustment member and forcing the angle adjustment member against the spacing adjustment wheel to produce frictional contact therebetween.

Preferably the spacing adjustment wheel has a conical end portion disposed in the periphery thereof at one end for guiding winding of the spacing cord round the spacing adjustment wheel.

The drive mechanism can include an operating device and a transmission shaft coupled between the spacing adjustment wheel and the operating device. The drive mechanism can further include

a worm and worm gear meshed therewith coupled between the operating device and the transmission shaft. Also, or in the alternative, the drive mechanism can include a driving force input member coupled to the transmission shaft, with the operating device having an operating portion at one end and an actuating portion at an opposite end for selectively rotating the driving force input member, the actuating portion having a coupling tip removably connectable to the driving force input member for rotating the transmission shaft. The operating device can include a hand crank.

The drive mechanism can include a reversible motor, a transmission shaft coupled between the reversible motor and the spacing adjustment wheel and driven by the reversible motor to rotate the spacing adjustment wheel, and a control circuit for operating the reversible motor in response to operator input. The transmission shaft can have a non-circular cross section fitted into a non-circular axial center through hole of the spacing adjustment wheel. The control circuit can include a remote controller having a signal transmitter adapted to transmit control signals, and a signal receiver adapted to receive control signals from the signal transmitter and to control operation of the reversible motor in response to the received control signal. Preferably the Venetian blind also includes a detector adapted to cut off power supply from

the reversible motor when the slats of the Venetian blind are fully lifted or lowered. The detector can include a fixedly supported locating block, a wheel supported in the locating block and coupled to the drive mechanism for rotation and axial movement upon operation of the reversible motor, and two limit switches disposed at two sides in axial displacement path of the wheel of the detector and electrically connected to the driving unit and adapted to cut off power supply from the motor when touched by the wheel of the detector. The limit switches can be respectively disposed in positions corresponding to the fully lifted and lowered positions of the slats.

The motor can be mounted in an operating device, that is removably connectable for driving the transmission shaft. The drive mechanism can further include a meshed worm and worm gear coupled between the motor and the transmission shaft.

In an alternative configuration, the drive mechanism includes a linking mechanism mounted in the headrail and having a first driving force input unit rotatable by an external rotary driving force, including a driving force receiving portion for receiving an external rotary driving force, and a first driving force output unit coupled to the spacing adjustment wheel; a second driving force input unit rotatable by the external rotary driving force and having a driving force receiving portion adapted to receive the external

rotary driving force, and a second driving force output unit coupled to the angle adjustment member; and an operating device selectively connectable to the first and second driving force input units for operation to rotate the driving force input units. The operating device can have an operating portion at one end for operation by hand and an actuating portion at an opposite end for selectively rotating the first and second driving force input units, the actuating portion having a coupling tip connectable to the driving force receiving portion of the selected driving force input unit. The operating device can include a hand crank or alternatively, a casing having the operating portion at one end, an actuating portion with a coupling tip connectable to the driving force receiving portion of the selected driving force input unit, a motor mounted within the casing and coupled to rotate the coupling tip, means for receiving a battery in the casing, and manually operable controls for selectively powering the motor from a battery.

DRAWINGS

These and other features, aspects, and advantages of the present invention will become better understood with reference to the following description, appended claims, and accompanying drawings, where:

FIGURE 1 is a perspective view of a Venetian blind according to the present invention, showing a friction transmission mechanism

and a limit detector installed therein;

FIGURE 2 is an exploded view of a cord roll-up unit of the friction transmission of FIG. 1;

FIGURE 3 is an elevational assembly view of the cord roll-up unit shown in FIG. 2;

FIGURE 4 is a sectional view of the cord roll-up unit shown in FIG. 3;

FIGURES. 5-7 are axial views showing continuous action of an angle adjustment member of the friction transmission during spacing and angle adjustments of the blinds of Fig. 1;

FIGURES. 8 and 9 are schematic drawings showing lift cord rolling up action of the cord roll-up unit of FIG. 2;

FIGURE 10 is a perspective view in an enlarged scale of the detector shown in FIG.1;

FIGURES. 11-13 are schematic drawings showing the action of the detector according to the present invention;

FIGURE 14 is an elevational view showing an alternative configuration of the blinds of FIG. 1, including a blind control system thereof;

FIGURE 15 is a fragmentary sectional elevational view of a portion of the blind control system of FIG. 14;

FIGURE 16 is a side view of an operating device portion of the blind control system of FIG. 14;

FIGURE 17 is a side view showing an alternative configuration of the operating device portion of FIG. 16;

FIGURE 18 is a side view showing another alternative configuration of the operating device of FIG. 16; and

FIGURE 19 is a pictorial diagram showing the Venetian blind having the friction transmission of Figs. 1-13 including features of the blind control system of FIGS. 14-18.

DESCRIPTION

Referring to FIGS. 1-4, the present invention provides a Venetian blind **10** having a novel transmission mechanism **100**. An exemplary configuration of the Venetian blind **10**, shown in FIG. 1, includes a headrail **11** and a slat set **12**. The headrail **11** is mountable to the top side of the window, and is formed to provide an inside holding chamber **111**, and two through holes **112** bilaterally disposed at a bottom side in communication with the holding chamber **111**. The slat set **12** includes a plurality of slats **121** and a bottom rail **123**. Each slat **121** has two wire holes **122** aligned with the through holes **112** of the headrail **11**. Because these features of the Venetian blind **10** are of the known art, no further detailed structural description is necessary. The friction transmission mechanism **100** includes a driving unit **20** and two cord roll-up units **30**.

As shown in FIG. 1, one preferred form of the driving unit

20 includes a reversible motor **21**, a transmission shaft **22**, a signal transmitter **23**, a signal receiver **24**, and a battery **25**. The motor **21** is mounted inside the holding chamber **111** of the headrail **11**. The transmission shaft **22** is a non-circular rod member, having one end coupled to the motor **21** for rotation by the motor **21**. The signal transmitter **23** can be a remote controller or wired controller for providing control signal to the signal receiver **24**. According to the present preferred embodiment, the signal transmitter **23** is a remote controller. The signal receiver **24** is electrically connected to the motor **21**, and adapted to control the operation of the motor **21** subject to the nature of the control signal received from the signal transmitter **23**. The battery **25** can be storage battery, dry battery, planar battery, cylindrical battery, or mercury battery mounted inside of the holding chamber **111** and electrically connected to the motor **21** to provide the motor **21** with the necessary working power. Alternatively, or in combination, an external source of power can be provided.

The cord roll-up units **30** are respectively mounted inside the holding chamber **111** of the headrail **11** in alignment with the through holes **112**, each including a spacing adjustment set **31**, an angle adjustment set **32**, and a linkage **33**, the set **31** being sometimes referred to as an amplitude modulation set, the set **32** being sometimes referred to as a frequency modulation set.

Referring to FIGS. 2-4 again, the spacing adjustment set **31** includes a spacing adjustment wheel **311**, a support **312**, and a spacing cord **313**. The spacing adjustment wheel **311** is comprised of a cylindrical wheel body **314**, a bobbin **315**, and a coupling member **316**. The cylindrical wheel body **314** comprises a stop flange **314a** extended around the periphery on the middle, a recessed hole **314b** disposed in the periphery adjacent the stop flange **314a** for accommodating the coupling member **316**, and an axially extended center through hole **314c** for accommodating the transmission shaft **22** of the driving unit **20**. The center through hole **314c** has a cross section fitting the cross section of the transmission shaft **22**. The bobbin **315** is sleeved onto the cylindrical wheel body **314** and stopped at one side of the stop flange **314a**, having a keyway **315a** in the inside wall thereof for receiving the coupling member **316** and a conical end portion **315b** peripherally disposed at one end. The support **312** is fixedly mounted inside the holding chamber **111** of the headrail **11**, having a stepped center through hole formed of a through hole **312b** and a recessed hole **312a**, and two shoulders **312c** bilaterally disposed outside the recessed hole **312a**. The inner diameter of the through hole **312b** is smaller than the recessed hole **312a**. The cylindrical wheel body **314** is rotatable within the recessed hole **312a**, being rotatably supported within the through hole **312b**. As illustrated in

FIGS. 1, 3, and 9, the spacing cord **313** has one end fixedly connected to the bobbin **315** of the spacing adjustment wheel **311**, and the other end wound round the bobbin **315** and then inserted through one through hole **112** of the headrail **11** and one wire hole **122** of each slat **12** and then fixedly connected to the bottom rail **123**.

The angle adjustment set **32** includes an angle adjustment wheel **321**, and an angle cord **322**. The angle adjustment wheel **321** comprises a protruding block **321a** disposed at one side, and an axially extended circular hole **321b**. By means of the circular hole **321b**, the angle adjustment wheel **321** is coupled to the cylindrical wheel body **314** of the spacing adjustment wheel **311** and stopped at one side of the stop flange **314a**, keeping the protruding block **321a** suspended or angularly confined between the shoulders **312c**. The angle cord **322** has one end fixedly connected to the angle adjustment wheel **321**, and the other end inserted through one through hole **112** of the headrail **11** and fixedly connected to each slat **121** and the bottom rail **123**.

The linkage **33** includes a spring member **331**, and a limiter **332**. According to the present preferred embodiment, the spring member **331** is a coiled spring mounted in the recessed hole **312a** of the support **312** and stopped between the angle adjustment wheel **321** and the connection area or shoulder between the recessed hole

312a and the through hole **312b**. The spring **331** forces the angle adjustment wheel **321** against the stop flange **314a** of the cylindrical wheel body **314**. The limiter **332**, fixedly mounted on the support **312**, can be formed for preventing the angle adjustment wheel **321** from falling out of the spacing adjustment wheel **311**. Also, the limiter **332** serves to keep the cords from falling off of the wheels in the event that the cords are loosened during installation, cleaning, or other such handling of the blinds.

The operation of the present invention is understood with reference to FIGS. 5-9, when the user operates the signal transmitter **23** of the driving unit **20** to transmit a control signal of lifting the Venetian blind, the signal receiver **24** immediately receives the signal. Upon receipt of the signal, the signal receiver **24** drives the motor **21** to rotate the transmission shaft **22**. Because the center through hole **314c** of the cylindrical wheel body **314** of the spacing adjustment wheel **311** is a non-circular hole that fits the transmission shaft **22**, rotating the transmission shaft **22** causes the spacing adjustment wheel **311** to be synchronously rotated to roll up the spacing cord **313**, as shown in FIGS. 8 and 9. When rotating the spacing adjustment wheel **311** to roll up the spacing cord **313**, the conical end portion **315b** guide the spacing cord **313** to be smoothly wound around the bobbin **315**. When the spacing adjustment wheel **311** rolls up the spacing cord **313**, the bottom rail

123 is lifted, thereby causing the slats **121** to be received and moved with the bottom rail **123** upwards toward the headrail **11** to the desired elevation.

Because the spring **331** forces the angle adjustment wheel **321** against the stop flange **314a** of the cylindrical wheel body **314** of the spacing adjustment wheel **311**, a friction resistance is produced between the angle adjustment wheel **321** and the cylindrical wheel body **314** of the spacing adjustment wheel **311**, thereby causing the angle adjustment wheel **321** to be synchronously rotated with the spacing adjustment wheel **311** during rotary motion of the spacing adjustment wheel **311**. During rotary motion of the angle adjustment wheel **321**, the angle cord **322** is moved, causing the slats **121** to be tilted. This tilting continues until the angle adjustment wheel **321** turns sufficiently for the protruding block **321a** to contact one of the shoulders **312c**. The contacted shoulder **312c** provides to the protruding block **321a** a reactive force which surpasses the friction resistance between the angle adjustment wheel **321** and the cylindrical wheel body **314** of the spacing adjustment wheel **311**, as shown in FIGS. 5 and 6, stopping the angle adjustment wheel **321** from rotation with the spacing adjustment wheel **311**. Therefore, when the angle adjustment wheel **321** is rotated to this angle, it is disengaged from the spacing adjustment wheel **311**. At this time, the transmission

shaft **22** continuously rotates the spacing adjustment wheel **311** to roll up the spacing cord **313** and to receive the slats **121** without changing the tilting angle of the slats **121**.

When releasing the slats **121**, one operates the signal transmitter **23** to transmit a control signal of releasing the slats to the signal receiver **24**. Upon receipt of the signal, the signal receiver **24** immediately drives the motor **21** to rotate in the reversed direction, thereby causing the transmission shaft **22** and the spacing adjustment wheel **311** to be rotated in the same reversed direction. Reverse rotation of the spacing adjustment wheel **311** lets off the spacing cord **313**, and therefore the bottom rail **123** and the slats **121** are lowered to extend out the Venetian blind **10**. During rotary motion of the spacing adjustment wheel **311** to let off the spacing cord **313**, the angle adjustment wheel **321** continues to be forced by the spring **331** against the cylindrical wheel body **314** of the spacing adjustment wheel **311**, thereby causing the angle adjustment wheel **321** to be synchronously rotated with the spacing adjustment wheel **311** to tilt the slats **121**. However, when the angle adjustment wheel **321** is reversed to such a position that the protruding block **321a** touches the other shoulder **312c** of the support **312** (see FIG. 7), the angle adjustment wheel **321** is stopped from rotation with the spacing adjustment wheel **311**. At this time, the transmission shaft **22** continuously rotates the

spacing adjustment wheel **311** to let off the spacing cord **313** and to release the slats **121** without changing the tilting angle of the slats **121**.

With respect to the tilting of the slats **121**, the operation is described hereinafter. At first, the user operates the signal transmitter **23** to transmit a slat tilting control signal to the signal receiver **24**. Upon receipt of the control signal, the signal receiver **24** immediately drives the motor **21** to rotate the transmission shaft **22** and the spacing adjustment wheel **311**, and to further cause the angle adjustment wheel **32** to be rotated synchronously to change the tilting angle of the slats **121**. In actual practice, it is not necessary to tilt the slats **121** at a wide angle, therefore the angle of rotation of the angle adjustment wheel **311** can be limited within a limited range. According to the present preferred embodiment, the angle adjustment wheel **321** is rotatable with the spacing adjustment wheel **311** within about 180°. The shoulders **312c** limit the angle of rotation of the angle adjustment wheel **321**. When the slats **121** are tilted to the desired angle, the motor **21** is stopped. (During the above-described slat angle tilting control operation, the amount of upward or downward movement of the bottom rail **11** due to rotation of the spacing adjustment wheel **311** is insignificant, without affecting the reliability of the operation.)

Referring to FIGS. 10-13, the friction transmission

mechanism **100** further includes a detector **60** installed in the middle of the transmission shaft **22**. When the slats **121** are moved to an upper limit or lower limit position, the detector **60** is operative to stop the motor **21**. According to the present preferred embodiment, the detector **60** includes a mounting plate **61**, a wheel **62**, two limit switches **63** and **64**, and a locating block **65**. The mounting plate **61** is fixedly fastened to the peripheral wall of the holding chamber **111** of the headrail **11**. The locating block **65** is fixedly mounted inside the holding chamber **111** of the headrail **11** having a center screw hole **651**. The wheel **62** is coupled to the transmission shaft **22** for synchronous rotation, having an outer thread **621** threaded into the center screw hole **651** of the locating block **65**. Rotation of the transmission shaft **22** causes synchronous rotation of the wheel **62** with the transmission shaft **22** and axial movement of the wheel **62** in the locating block **65**. The limit switches **63** and **64** are respectively mounted on the mounting plate **61** at two sides relative to the wheel **62** (in such positions where the wheel **62** touches one limit switch **63** or **64** when the slats **121** are moved to the upper limit or lower limit position), and electrically connected to the motor **21**. When the slats **121** moved to the upper or lower limit position, the wheel **62** touches one limit switch **63** or **64**, thereby causing the limit switch **63** or **64** to cut off power from supplying the motor **21** in the direction activating the limit switch.

The present invention, as described above in connection with FIGS. 1-13, provides a number of advantages. For example:

1. Slat lifting and tilting dual-control function:

The friction resistance between the angle adjustment wheel and the spacing adjustment wheel causes the angle adjustment wheel to be synchronously rotated with the spacing adjustment wheel, and the shoulders of the support and the protruding block of the angle adjustment wheel serve as clutch means to control synchronous rotation of the angle adjustment wheel with the spacing adjustment wheel, and therefore one single driving source is sufficient to control rotation of the spacing adjustment wheel, which controls lifting of the slats, and the angle adjustment wheel, which controls tilting of the slats.

2. Single drive source and compact size:

Because one single driving source is sufficient to drive the spacing adjustment wheel and the angle adjustment wheel, the invention is inexpensive to manufacture and, requires less installation space.

3. Durable mechanical design:

Because the friction transmission mechanism is provided with a detector, the motor is immediately stopped when the slats reach their upper or lower limit position, preventing damage to the parts of the mechanism. It will be understood that a

torque-limiting device can be substituted for the detector 60, either in the form of a slip clutch, hydraulic coupling or the like connected between the motor **21** and the roll-up units **30**, or in the form of a current limiting feature of the motor **21** for permitting stalled operation thereof without overheating, such devices being known to those having skill in the relevant arts.

With further reference to FIGS. 14 and 15, an alternative configuration of the Venetian blind 10, designated **10B**, incorporates a blind control system **40** having a linking mechanism **42** that combines a lifting mechanism **43** for lifting a blind body that includes a set of slats **16** and a bottom rail **17**, and a tilting mechanism **44** for tilting the slats. The blind control system **40** also includes an operating device 46 having a coupling tip **28** and being further described below, for selective operation of the lifting and/or tilting mechanisms **43** and **44**. The lifting mechanism **43** includes a driving force input unit **51**, a spring member **56**, and two pulleys **57**. The driving force input unit **51** includes a bobbin **52** and a rod member **53** coaxially and fixedly fastened to the bottom side of the bobbin **52**. The rod member **53** has a driving force receiving portion **54** in the bottom end thereof, and a toothed portion **55** around the periphery. The driving force input unit **51** is fastened pivotally with the inside of the right end of a headrail **11B** of the Venetian blind **10B**, with the rod member **53** projecting downwardly therethrough.

The headrail **11B** has a toothed portion **14** that is engagable by the toothed portion **55** of the rod member **53**. A spring member **56** is connected between the top side of the bobbin **52** and the top sidewall of the headrail **11B** to impart a downward pressure to the bobbin **52** and the rod member **53**, keeping the toothed portion **55** of the rod member **53** meshed with the toothed portion **14**, the rod member **53** being axially moveable upwardly against the spring **56** sufficiently to disengage the toothed portions **14** and **55** for permitting rotation of the rod member. The pulleys **57** are fastened pivotally with the inside the headrail **11B** and symmetrically located on the left and right ends of the headrail **11B**. The Venetian blind **10B** includes two lift cords **15** symmetrically inserted through the slats **16**, a bottom end being fixedly connected to the bottom rail **17**, and a top end inserted upwardly into the inside of the headrail **11B** and extended over the periphery of the corresponding pulley **57** and then fastened to the periphery of the bobbin **52** of the driving force input unit **51**. When rotating the driving force input unit **51**, the bobbin **52** is rotated to roll up or let off the lift cords **15**, and therefore the bottom rail **17** is lifted or lowered, carrying the slats **16** to the desired elevation, i.e., the periphery of the bobbin **52** forms an output force driving unit **58**.

The tilting mechanism **44**, for controlling the tilting angle of the slats **16**, includes a worm **155** and a worm gear **156** adapted

to rotate a tilt rod **157**, causing it to move two ladder tapes **18** and to further control the tilt angle of the slats of the Venetian blind **10B**. The worm **155** is mounted on a rod member 153 having a driving force receiving portion **154** in the bottom end for receiving the coupling tip **28** of the operating device **46**. In general, the linking mechanism **42** has two independent driving force input units (driving force receiving portions and two driving force output units so that the user can couple the operating device **46** to the driving force input units selectively, and operate the operating device **46** to lift the bottom rail **17** of the Venetian blind **10B** to the desired elevation or, to adjust the tilting angle of the slats **16** of the blind body of the Venetian blind **10B** by engagement of the coupling tip **28** with the driving force receiving portion of the tilting mechanism **44**.

The operating device **46** is substantially a rod-like member that is preferably not directly connected to the linking mechanism **42**. The user can hold one end of the operating device **46** with the hand in a vertical position, keeping the other end of the device at the elevation of the headrail **11B**. The operating device **46** has an operating portion **26** at its one end for the holding of the hand, and an actuating portion **27** at its other end, terminating in the coupling tip **28**. The coupling tip **28** is detachably connectable to either of the driving force receiving portions **54** and **154** of the linking

mechanism **42**. After connection of the coupling tip **28** to the selected receiving portion, the user can rotate the operating portion **26** with the hand, enabling the rotary driving force to be transmitted through the selected driving force receiving portion **54** or 154 of the linking mechanism **42**. Thus the user can operate the operating device **46** to adjust the Venetian blind **10B**.

When adjusting the height or spacing of the slats 16, the coupling tip **28** of the actuating portion **26** of the operating device **46** is forced into engagement with the driving force receiving portion **54** of the driving force input unit **51**, and then the operating device **46** is pushed to move the rod member **53** and the bobbin **52** upwards against the spring member **56** and to disengage the toothed portion **55** from the toothed portion **14**, and then operating device **46** is manipulated to rotate the driving force input unit **51**, causing the bobbin **52** to roll up or let off the lift cords **15**, and therefore the bottom rail **17**, together with slats **16** resting thereon, is lifted or lowered to the desired elevation. After the blind body **12B** has been adjusted to the desired elevation, the operating device **46** is disengaged from the driving force receiving portion **54**, simultaneously enabling the driving force input unit **51** to be lowered such that the toothed portion **55** of the driving force input unit **51** meshes with the toothed portion **14** of the headrail **11B**, and therefore the bobbin **52** is locked and, the blind body **12B** is fixed

in position.

Similarly, the operating device **46** may be coupled to the rod member **153** of the tilting mechanism **44** for adjusting the tilt angle of the slats **16**, rotation of the coupling tip **28** being transmitted from the driving force receiving portion **154** to the worm **155** and transmitted by the worm gear **156** to the tilt rod **157** to operate the ladder tapes **18**. The tilt angle remains set following withdrawal of the operating device **46** because of the self-locking action of the worm **155** in its engagement with the worm gear **156**.

With further reference to FIG. 16, an alternative configuration of the operating device, designated **46B**, includes a first handgrip **261**, an elongated counterpart of the actuating portion, designated **271** fastened pivotally with the front end of the first handgrip **261** and terminating in the coupling tip **28** having a hexagonal shape and which can be inserted into the selected driving force receiving portion **54** or **154**, each having a corresponding hexagonal shape and a tapered outer hole for facilitating engagement by the coupling tip **28**. The operating device **46B** also includes a crank **262** fastened pivotally with the first handgrip **261** and coupled to the elongated actuating portion **271**, and a second handgrip **263** fixedly fastened to one end of the crank **262** in offset relation to the first handgrip **261**. The crank **262** and the second handgrip **263** form the operating portion **26**.of the operating device

46B. When in use, the user can hold the first handgrip **261** with one hand and rotate the second handgrip **263** with the other hand. When rotating the second handgrip **263**, the elongated actuating portion **271** is rotated with the crank **262** and the second handgrip **263** relative to the first handgrip **261**.

With further reference to FIG. 17, an alternative configuration of the operating device, designated **70**, is an electrically controlled device including a casing **71**, a rod-like actuating portion **72** forwardly extended out of the front side of the casing **71**, a motor **77** mounted inside the casing **71** and adapted to rotate the rod-like actuating portion **72**, a battery power supply **78** mounted inside the casing **71** and electrically connected to the motor **77**, a control panel **74** located on the outside wall of the casing **71** and including of a set of control buttons **73** adapted to control on/off status and forward/backward rotation of the motor, and a protective sleeve **75** fixedly fastened to the front side of the casing **71** around the rod-like actuating portion **72**. The rod-like actuating portion **72** has a front end extended out of the front end of the protective sleeve **75** and terminating in the coupling tip **28**. The operating device **70** also includes suitable electrical connections between the control buttons **73**, the battery **78**, and the motor **77** for operation thereof, such being within the ordinary skill of the art.

With further reference to FIG. 18, an alternative

configuration of the electrically controlled operating device, designated **80**, includes a tubular main body **81**, a motor **82** mounted in the front end of the tubular main body **81**, a rod-like actuating portion **83** rotationally coupled to the motor **82** and extended out of the tubular main body **81** to form the coupling tip **28**. The operating device **80** also includes control buttons **84** located on the tubular main body **81** near its rear end remote from the motor **82** and the rod-like actuating portion **83**, the buttons **84** being electrically connected to the motor **82** and to a battery **88** that is located within the main body **81** for operation of the motor **82**.

With further reference to FIG. 19, the present invention provides a Venetian blind, designated **10C**, that combines features of the mechanism **100** of FIGS 1-13 with features of the control system **40** of Figs. 14-18, wherein one single operating device is effective to simultaneously control the lifting of the blind body and tilting of the slats of any of several Venetian blinds. More particularly, the blind **10C** has a counterpart of the tilting mechanism, designated drive unit **44B**, with a counterpart of the transmission shaft **22** substituted for the tilt rod **157** and driving a pair of the cord roll-up units **30** as described above. Thus the operating device **46**, when coupled with the coupling tip **28** engaging the force receiving portion **154**, is effective for adjusting the height as well as the tilt of the slats **16**. It will be understood

that the operating device **46** can be permanently connected to the drive unit 44B as an alternative to being removably connectable thereto.

Basically, the linking mechanisms of conventional blinds commonly use (or can use) a rotary action to achieve blind body lifting/lowering or extending/receiving control and slats tilting control. Therefore, the lifting and tilting devices of the present invention can be used in any of a variety of blinds.

As indicated above, the invention has the advantages as follows:

1. Because the invention does not use any lift cord or like means to achieve blind body lifting control, it eliminates the possibility of the hanging of the head of a person (more particularly a child) on the lift cord accidentally.
2. Because the blind control system of the present invention (in the preferred configurations described above) has no control member exposed to the outside of the blind, the sense of beauty of the blind is maintained intact.
3. Because conventional electric blinds have an independent motor, power adapter, control circuit, and etc., their manufacturing cost is high. The invention as described above in connection with Figs. 14-19 can use one electrically controlled operating device to control the mechanical linking mechanism of each of a

number of blinds. Therefore, the invention greatly reduces the installation cost of multiple blinds in one house.

4. Conventional battery-powered electric blinds have the battery installed in the headrail. When replacing the battery, the user needs to use a chair or ladder so as to access to the battery in the headrail. This battery replacing job is inconvenient to achieve. According to the present invention as described above in connection with Figs. 17 and 18, the battery is installed in the operating device, which is separated from the blind. Therefore, the user can replace the battery of the operating device conveniently.
5. Because the invention does not use the spring power of a spring member or the tension of a cord member to hold the blind body at the desired elevation, the invention can control and maintain the position status of the blind body stably.

Although particular embodiments of the invention have been described in detail for purposes of illustration, various modifications and enhancements may be made without departing from the spirit and scope of the invention. Accordingly, the spirit and scope of the appended claims should not be limited to the description of exemplary and/or preferred versions contained herein.